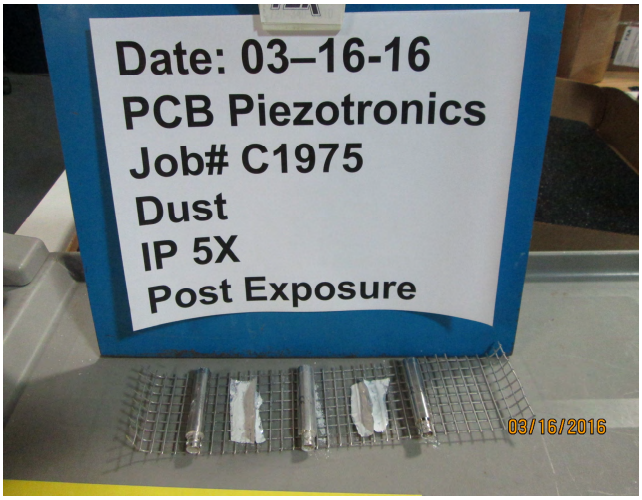
Cascade Technical Sciences, Inc. Reports

IP55 Rated for Protection Against Ingress of Water,
Report CTC1975-1

IP55 Rated for Protection Against Dust,
Report CTC1975-2



PCB Piezotronics Model 130A24

Water and Dust Resistant Microphone and Preamplifier

Cascade Technical Sciences, Inc.

Hillsboro, Oregon/Longmont Colorado

Report CTC C1975-1

May 19, 2016

For: PCB Piezotronics

Prepared By:	Meg Talbert Digitally signed by Meg Talbert DN: cn=Meg Talbert, o=Element Materials Technology, ou=Quality, email=meg.talbert@element.com, c=US Date: 2016.05.19 23:31:10 -06'00'	05/19/2016	
	Element Denver Quality Administrator	**Date**	
Reviewed By:	Joe Fratiello Digitally signed by Joe Fratiello DN: cn=Joe Fratiello, o=Element Materials Technology, ou=Laboratry, email=Joe.Fratiello@Element.com, c=US Date: 2016.05.24 12:59:45 -06'00'	05/20/2016	
	Element Denver Laboratory Manager	**Date**	
Concurred With:	Joe Fratiello Digitally signed by Joe Fratiello DN: cn=Joe Fratiello, o=Element Materials Technology, ou=Laboratry, email=Joe.Fratiello@Element.com, c=US Date: 2016.05.24 16:08:57 -06'00'	05/20/2016	
	Element Portland Quality Manager (Denver Lab Manager signing in absence of QM)	**Date**	

Administrative Data

Prepared for: PCB Piezotronics
3425 Walden Ave
Depew, NY 14043

Test Facility: Cascade Technical Sciences, Inc.
1530 Vista View Drive
Longmont, CO 80504

Test(s) Performed	Test Specification (Paragraph/Section)
Spraying Water (IP-X4)	CEI/IEC 60529:2013 Para. 14.2.4
Jet Spray (IP-X5)	CEI/IEC 60529:2013 Para. 14.2.5

Item(s) Tested (Description)	Part Number(s)	Serial Number(s)
Microphones	130A24	44296
Microphones	130A24	44293
Microphones	130A24	44292

Rev.	Reason For Revision	Date	Approval
---	Report Issued.	05/19/2016	MJT

Date Test Items Received: 03/01/2016

Testing Initiated Date: 05/04/2016

Testing Completed Date: 05/04/2016

Cascade Tek – Hillsboro, Oregon/Longmont, Colorado

May 19, 2016 Certification No: CTC C1975-1

Attention: Mr. Michael Thibeault
PCB Piezotronics
3425 Walden Ave
Depew, NY 14043

Reference:
a. CTek Job No.: C1975
b. CTek Quote No.: 18127A
c. Customer Purchase Order No.: WE00005021
d. Technical Specification: 1. CEI/IEC 60529: 2013

Cascade Technical Sciences, Inc. hereby certifies that the following test sample(s) were subjected to the following test(s).

Quantity	Description	Model/Part Number	Serial Number(s)
1	Microphones	130A24	44296
1	Microphones	130A24	44293
1	Microphones	130A24	44292

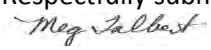
1. Spraying Water (IP-X4) Test per Reference (b) Item 1 and (d1), the non-operating samples were subjected to 5 minutes of spraying water exposure at 180 degrees from vertical, using a nozzle per Fig. 5 (reference d1), and a flow rate of ten liters/minute. No visible water ingress was observed.

2. Jet Spray (IP-X5) Test per Reference (b) Item 2 and (d1), the non-operating samples were subjected to 3 minutes of water jet spray exposure, from a distance of 2.5 – 3 meters, using a nozzle per Fig. 6 (reference d1), with a 6.3 mm internal diameter, and a delivery rate of 12.5 liters/minute. No visible water ingress was observed.

Testing was done in accordance with the above references as evidenced and reported in the accompanying data. The test samples were returned to the customer for evaluation.

The original of this report is on file at Cascade Technical Sciences, Inc. under the above referenced certification number for review by authorized personnel. The results of the testing reported herein relate only to the actual items tested.

Respectfully submitted,



Meg Talbert
Quality Administrator
Cascade Technical Sciences, Inc.

The objective of this test program was to subject customer provided test hardware to environmental simulation in compliance with customer stated specification, including any authorized modification, deviations or concessions to the original requirements. The hardware consisted of items identified in the appropriate sections of this report. In addition to test hardware identification, each section contains information that describes the associated test setup and performance and the resulting data. Cascade Technical Sciences, Inc. measuring instruments used in testing were calibrated according to the requirements of ANSI/NCSL Z540-1 and ISO/IEC 17025, and are traceable NIST or NMI. Calibration records are on file and available for inspection by request. Because the test methods are well established and are qualitative or semi-quantitative in nature, Cascade Technical Sciences, Inc., Inc. does not apply measurement uncertainty unless obligated by contract. Any test hardware operational setups and resulting evaluations or inspections performed by the customer are not included in this report, unless they were explicitly requested. While observations and/or specification compliance statements may be reported, no interpretations or opinions regarding customer product performance are intended. Unless otherwise indicated in the appropriate report section, all contract obligations were met and the test objective achieved.

Test Data Log – Protection Against Water (IPX1 through IPX9)

Section 1 – Customer and Test Information

Job Number: C1975
Customer: PCB Piezotronics

Date Started: 5/4/2016
Date Completed: 5/4/2016

QA Reviewer: Meg Talbert
Signature: Meg Talbert

Responsible Technician: Keefe Hart
Quote Issued By: Joe Fratiello

Customer Witness: No ☒ Yes ☐ Name: N/A

Section 2 – Test parameters

Type of Test: Protection Against Water Intrusion
Test Specification: IEC 60529:2013 Ed. 2.2, Sec. 14.2.4

Test Description:

- IP Designation: IPX4
- Test Means: Spray nozzle ± 180° from vertical.
- Water Flow Rate: 10 l/min ±5 %
- Test Conditions: IEC 60529, Ed. 2.2, Sec. 14.2.4
- Test Duration: 1 min/m², minimum of 5 minutes.
- Water Temperature: The water temperature does not differ from that of the specimen by more than 5^0 K.
- Water Pressure: N/A
- Instructions on Disassembling the Specimen Have Been Received: ☒ Yes ☐ No
- Passing Criteria: In general, if any water has entered, it shall not:
  - Be sufficient to interfere with the correct operation of the equipment or impair safety.
  - Deposit on insulation parts where it could lead to tracking along the creepage distances.
  - Reach live parts or windings not designed to operate when wet.
  - Accumulate near the cable end or enter the cable if any.
- Additional Instructions: Spraying Water: Samples to be sprayed 180 degrees from vertical using a nozzle per Figure 5. Water flow shall be at a rate of 10 L/min for a period of 1 minute per square meter of enclosure for a minimum of 5 minutes. Water temperature shall not differ by more than 5K from sample temperature.

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	Sample S/N or Other Identifier	Qty.
Microphones	130A24	44296	1
Microphones	130A24	44293	1
Microphones	130A24	44292	1

Section 4 – Test Equipment

ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
FR429	Spray Nozzle	Guangzhou Zhilitong Electromechanical	ZLT-JL1	JL011305	06/24/15	06/24/16
FR506	Stop Watch	Digi-Sense	94460-28	160157786	01/28/16	01/28/18
FR66	Tape Measure	Stanley	LeverLock	30-824	Verified Before Use	
FR135	Thermometer	Fluke	54 II B	20380005	06/17/15	06/17/16
FR512	Temperature/ Relative Humidity Meter	Cole-Parmer	90080-03	160173042	03/05/16	03/05/18

Section 5 – Test Log

Customer Name: PCB Piezotronics

Job Number: C1975

Laboratory Temperature: +71°F

Laboratory Humidity: 26% RH

Initials	Date	Time	Notes	Photo
KH	5/4/2016	1100	Samples are mounted in a vertical orientation. The exposure will concentrate on the microphone end of the sample opposite the cable end. This is per customer instruction.	☒
KH	5/4/2016	1120	Water temperature is +16.2°C and sample temperature is +20.2°C; no thermal conditioning is necessary.	☐
KH	5/4/2016	1145	Spray nozzle calibration is verified.	☐
KH	5/4/2016	1155	Begin the 5 minute exposure.	☒
KH	5/4/2016	1200	Exposure is complete.	☐
KH	5/4/2016	1205	Remove the samples from the spray cart and hand dry the exterior of the sample.	☐
KH	5/4/2016	1210	Unscrew the cover on the microphone end and dry the interior surface exposed under the cover.	☐
KH	5/4/2016	1210	Peel back the adhesive membrane material and inspect for any indication of water ingress.	☐
KH	5/4/2016	1215	There is no sign of water below the peel back membrane. Install new membrane pads on each sample for subsequent testing.	☒
KH	5/4/2016	1230	Samples will progress on to IPX5 level spray test.	☐
KH	5/4/2016	1245	IPX4 testing is complete.	☐


CASCADE
TEK
Date: 05–04-2016
PCB Piezotronics
C1975
Spraying Water
IP X4
05/04/2016


Date: 05–04-2016
PCB Piezotronics
C1975
Spraying Water
IP X4
05/04/2016


Date: 05–04-2016
PCB Piezotronics
C1975
Spraying Water
IP X4
05/04/2016


Date: 05–04-2016
PCB Piezotronics
C1975
Spraying Water
IP X4
05/04/2016

Date: 05–04-2016

PCB Piezotronics

C1975

Spraying Water

IP X4

Post Exposure

05/04/2016

Test Data Log – Protection Against Water (IPX1 through IPX9)

Section 1 – Customer and Test Information

Job Number: C1975
Customer: PCB Piezotronics

Date Started: 5/4/2016
Date Completed: 5/4/2016

QA Reviewer: Meg Talbert
Signature: Meg Talbert

Responsible Technician: Keefe Hart
Quote Issued By: Joe Fratiello

Customer Witness: No ☒ Yes ☐ Name: N/A

Section 2 – Test parameters

Type of Test: Protection Against Water Intrusion
Test Specification: IEC 60529, Ed. 2.2, Sec. 14.2.5

Test Description:

- IP Designation: IPX5
- Test Means: Spray nozzle ± 180° from vertical.
- Water Flow Rate: 12.5 l/min ±5 %
- Test Conditions: IEC 60529, Ed. 2.2, Sec. 14.2.5
- Test Duration: 1 min/m², minimum of 3 minutes.
- Water Temperature: The water temperature does not differ from that of the specimen by more than 5^0 K.
- Water Pressure: N/A
- Instructions on Disassembling the Specimen Have Been Received: ☒ Yes ☐ No
- Passing Criteria: In general, if any water has entered, it shall not:
  - Be sufficient to interfere with the correct operation of the equipment or impair safety.
  - Deposit on insulation parts where it could lead to tracking along the creepage distances.
  - Reach live parts or windings not designed to operate when wet.
  - Accumulate near the cable end or enter the cable if any.
- Additional Instructions: Water Jet Spray: Samples to be sprayed with a nozzle that has a 6.3mm diameter per Figure 6 from a distance of 2.5-3 meters. Water flow shall be at a rate of 12.5l/minute for a period of 1 minute per square meter of enclosure for a minimum of 3 minutes. Water temperature shall not differ by more than 5K from sample temperature. Water shall have no harmful effects on enclosure.

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	Sample S/N or Other Identifier	Qty.
Microphones	130A24	44296	1
Microphones	130A24	44293	1
Microphones	130A24	44292	1

Section 4 – Test Equipment

ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
FR84	Spray Nozzle	CTEK	6.3 MM	1	Factory Set	
FR506	Stop watch	Digi-Sense	94460-28	160157786	01/28/16	01/28/18
FR66	Tape Measure	Stanley	LeverLock	30-824	Verified Before Use	
FR135	Thermometer	Fluke	54 II B	20380005	06/17/15	06/17/16
FR512	Temperature/Relative Humidity Meter	Cole-Parmer	90080-03	160173042	03/05/16	03/05/18

Section 5 – Test Log

Customer Name: PCB Piezotronics

Job Number: C1975

Laboratory Temperature: +71°F

Laboratory Humidity: 26% RH

Initials	Date	Time	Notes	Photo
KH	5/4/2016	1250	Samples are mounted on a spray cart. Exposure will concentrate for the entire 3 minute exposure on the end of the microphone with the removable cover per customer direction.	☒
KH	5/4/2016	1250	Water temperature is +16.5°C and sample temperature is +19.8°C; no thermal conditioning is necessary.	☐
KH	5/4/2016	1250	Nozzle flow has been verified.	☐
KH	5/4/2016	1251	Begin the 3 minute exposure.	☒
KH	5/4/2016	1255	Exposure is complete.	☐
KH	5/4/2016	1255	Samples are removed from the spray cart and hand dried.	☐
KH	5/4/2016	1258	End covers are removed and exposed membrane is hand dried.	☐
KH	5/4/2016	1300	Membrane pieces are removed and the interior of the sample is inspected for any indication of water presence.	☒
KH	5/4/2016	1300	No water is detected inside of the samples.	☒
KH	5/4/2016	1315	Samples will be returned to the customer for operational verification.	☐
KH	5/4/2016	1315	Testing is complete.	☐


CASCADE
TEK
Date: 05–04-2016
PCB Piezotronics
C1975
Water Jet Spray
IP X5
05/04/2016

Date: 05-04-2016
PCB Piezotronics
C1975
Water Jet Spray
IP X5
05/04/2016

Date: 05–04-2016

PCB Piezotronics

C1975

Water Jet Spray

IP X5

Post Exposure

05/04/2016

Cascade Technical Sciences, Inc.

Hillsboro, Oregon/Longmont Colorado

Report CTC C1975-2

May 31, 2016

For: PCB Piezotronics

Prepared By:	Meg Talbert — Digitally signed by Meg Talbert DN: cn=Meg Talbert, o=Element Materials Technology, ou=Quality, email=meg.talbert@element.com, c=US Date: 2016.05.31 20:41:50 -06'00'	05/31/2016
	Element Denver Quality Administrator	**Date**
Reviewed By:	Joe Fratiello — Digitally signed by Joe Fratiello DN: cn=Joe Fratiello, o=Element Materials Technology, ou=Laboratry, email=Joe.Fratiello@Element.com, c=US Date: 2016.06.01 10:52:53 -06'00'	05/31/2016
	Element Denver Laboratory Manager	**Date**
Concurred With:	Joe Fratiello — Digitally signed by Joe Fratiello DN: cn=Joe Fratiello, o=Element Materials Technology, ou=Laboratry, email=Joe.Fratiello@Element.com, c=US Date: 2016.06.01 10:53:29 -06'00'	05/31/2016
	Element Portland Quality Manager	**Date**

(Denver Lab Manager signed in absence of QM)

Administrative Data

Prepared for: PCB Piezotronics
3425 Walden Ave
Depew, NY 14043

Test Facility: Cascade Technical Sciences, Inc.
1530 Vista View Drive
Longmont, CO 80504

Test(s) Performed	Test Specification (Paragraph/Section)
Settling Dust	CEI/IEC 60529:2013 Para. 13.4 & 13.5

Item(s) Tested (Description)	Part Number(s)	Serial Number(s)
Microphones	130A24	44296
Microphones	130A24	44293
Microphones	130A24	44292

Rev.	Reason For Revision	Date	Approval
---	Report Issued.	05/19/2016	MJT
A	Corrected photos.	05/31/2016	MJT

Date Test Items Received: 03/01/2016

Testing Initiated Date: 03/15/2016

Testing Completed Date: 03/16/2016

Cascade Tek – Hillsboro, Oregon/Longmont, Colorado

May 31, 2016 Certification No: CTC C1975-2

Attention: Mr. Michael Thibeault
PCB Piezotronics
3425 Walden Ave
Depew, NY 14043

Reference: a. CTek Job No.: C1975
b. CTek Quote No.: 18127A
c. Customer Purchase Order No.: WE00005021
d. Technical Specification: 1. CEI/IEC 60529: 2013

Cascade Technical Sciences, Inc. hereby certifies that the following test sample(s) were subjected to the following test(s).

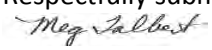
Quantity	Description	Model/Part Number	Serial Number(s)
1	Microphones	130A24	44296
1	Microphones	130A24	44293
1	Microphones	130A24	44292

1. Dust Test per Reference (b) Item 3 and (d1), the non-operating samples were subjected to eight hours of dust exposure at a concentration of two kg/m^3. No visible dust ingress was observed.

Testing was done in accordance with the above references as evidenced and reported in the accompanying data. The test samples were returned to the customer for evaluation.

The original of this report is on file at Cascade Technical Sciences, Inc. under the above referenced certification number for review by authorized personnel. The results of the testing reported herein relate only to the actual items tested.

Respectfully submitted,



Meg Talbert
Quality Administrator
Cascade Technical Sciences, Inc.

The objective of this test program was to subject customer provided test hardware to environmental simulation in compliance with customer stated specification, including any authorized modification, deviations or concessions to the original requirements. The hardware consisted of items identified in the appropriate sections of this report. In addition to test hardware identification, each section contains information that describes the associated test setup and performance and the resulting data. Cascade Technical Sciences, Inc. measuring instruments used in testing were calibrated according to the requirements of ANSI/NCSL Z540-1 and ISO/IEC 17025, and are traceable NIST or NMI. Calibration records are on file and available for inspection by request. Because the test methods are well established and are qualitative or semi-quantitative in nature, Cascade Technical Sciences, Inc., Inc. does not apply measurement uncertainty unless obligated by contract. Any test hardware operational setups and resulting evaluations or inspections performed by the customer are not included in this report, unless they were explicitly requested. While observations and/or specification compliance statements may be reported, no interpretations or opinions regarding customer product performance are intended. Unless otherwise indicated in the appropriate report section, all contract obligations were met and the test objective achieved.

Test Data Log – Protection Against Solid Foreign Objects (IP5X through IP6X)

Section 1 – Job Information

Job Number: C1975
Customer: PCB Piezotronics
Date Started: 3/15/2016
Date Completed: 3/16/2016

QA Reviewer: Meg Talbert
Signature: Meg Talbert
Responsible Technician: Keefe Hart
Quote Issued By: Joe Fratiello

Customer Witness: No ☒ Yes ☐ Name: N/A

Section 2 – Test Parameters

Type of Test: Settling Dust
Test Specification: IEC 60529: 2013 Ed. 2.2, Sec. 13.4 & 13.5

Test Description:

- IP Designation: IP5X
- Enclosure Category: 2 - No pressure difference.
- Dust: 2 kg of talcum powder per cubic meter of the test chamber volume.
- Air On: 2 seconds
- Air Off: 3 minutes
- Number of Cycles: 160
- Total Test Time: 8 hours
- Instructions on Disassembling the Specimen Have Been Received: ☐ Yes ☒ No
- Passing Criteria: No deposit of dust is observable inside the enclosure at the end of the test.
- Additional Instructions:

Section 3 – Test Sample Information

Sample Description	Sample P/N or Model No.	Sample S/N or Other Identifier	Qty.
Microphones	130A24	44296	1
Microphones	130A24	44293	1
Microphones	130A24	44292	1

Section 4 – Test Equipment

ID No.	Description	Manufacturer	Model No.	Serial No.	Last Cal	Next Cal
1224	Dust Chamber	Thermotron	D27	29644	Reference Only	
FR71	Test Dust	Equate	Talcum Powder	NA	Factory Mix	
FR449	Dust Sieve	Dual Manufacturing	SP8-2	200	Reference Only	
FR72	Manometer	Dwyer	24-D	3343	Reference Only	
FR422	Electronic Precision Balance	Mettler Toledo	PR5002	1120271907	01/28/16	01/28/17
FR494	Stop Watch	Control Company	94460-28	140586526	01/29/15	01/29/17
FR513	Temperature/Relative Humidity Meter	Cole-Parmer	90080-03	160173038	03/05/16	03/05/18

Section 5 – Test Log

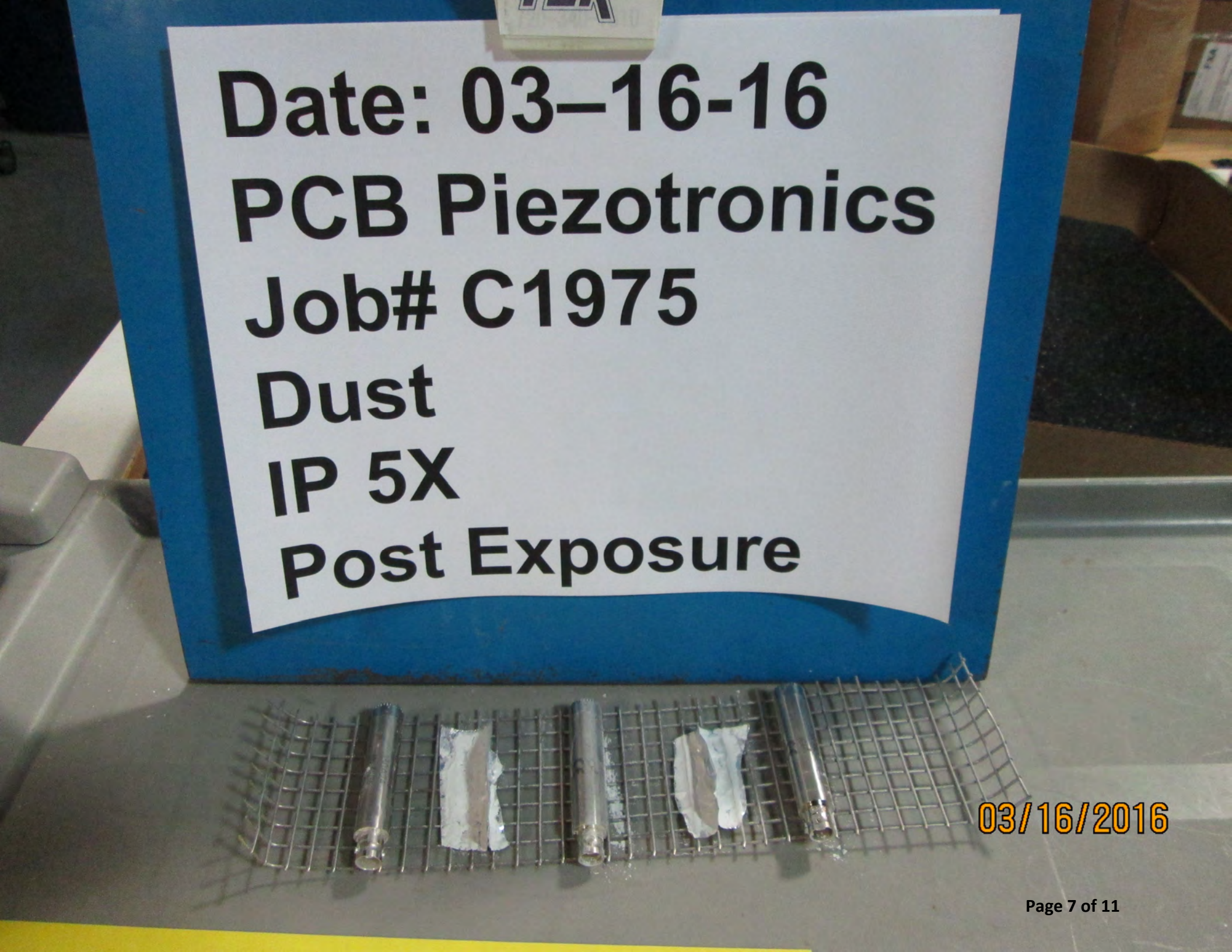
Customer Name: PCB Piezotronics

Job Number: C1975

Laboratory Temperature: +70°F

Laboratory Humidity: 20% RH

Initials	Date	Time	Notes	Photo
KH	3/15/2016	1500	Samples are placed in dust chamber.	☒
KH	3/15/2016	1515	Begin 8 hour exposure.	☐
KH	3/16/2016	0800	8 hour exposure is complete.	☐
KH	3/16/2016	0815	Brush excess dust off of the exterior of the samples	☐
KH	3/16/2016	0815	Remove samples from dust chamber and hand clean the exterior of the sample to remove any remaining dust.	☐
KH	3/16/2016	0820	All 3 samples have visible dust collection inside of the connector end.	☒
KH	3/16/2016	0820	The end cap and black cover are removed from all 3 samples. No dust ingress under the black cover is observed.	☒
KH	3/16/2016	0830	Samples will remain on site for further testing.	☐
KH	3/16/2016	0830	Dust testing is complete.	☐


Date: 03–16-16
PCB Piezotronics
Job# C1975
Dust
IP 5X
Post Exposure
03/16/2016


03/16/2016


03/16/2016

Date: 03 - 16 - 16

PCB Piezotronics

Job# C1975

Dust

IP-5X

Post Exposure

03/16/2016

Job# C1975

Dust

IP-5X

Post Exposure

03/16/2016